SPRINTING PATTERNS IN YOUTH INITIATING FROM TWO DIFFERENT TYPES OF STARTS

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by
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ABSTRACT

SPRINTING PATTERNS IN YOUTH INITIATING FROM TWO DIFFERENT TYPES OF STARTS. (May 2011)

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The sprint start is a specialized movement skill. Proficiently performed start action may be evident in specific movements, such as the "drive", as well as in the acceleration time. Different constraints can influence the performance of the sprint start, one of which is instructions. Therefore, the purpose of this study was to determine if the sprint start movements and acceleration time of a 30m sprint is altered using different instructions in youth. Eight boys and one girl (11.7 ± .35 years) participated in this study. Participants were recruited from the local after school program. Height, weight, and sitting height were measured and sitting height to height ratio was calculated. Predicted adult height and current height to predicted height ratio were calculated. A survey on sports' experiences was also administered. The sprint testing procedures included a randomized design utilizing three groups: a control (C), verbal (VE), and video (V). Each group was assigned to one intervention per day or testing session. Participants performed four 30m (2 pre, 2 post) sprints for all testing protocols. The better performance was selected for analysis. The intervention consisted of either participants watching video instructions on a falling start and subsequent acceleration (V), listening to scripted verbal instructions and practicing a falling start and subsequent acceleration (VE), or having no

instructions at all regarding a sprint start but still practicing (C). Following the intervention, a 30m sprint post-test was administered. The sprint start was video recorded and sprint times at each 5m of the 30m sprint were obtained for all measurements. From the interval sprinting times, velocity (m/s) and acceleration (m/s^2) were calculated. The distance of the acceleration for each condition was obtained from acceleration-time curves. Qualitative observations of three main features of the sprint start were performed. A repeated measures ANOVA ($p < 0.05$) revealed no significant differences in acceleration time. However, general tendencies of the body movements related to improving the start and thus acceleration phase, changed, although not significantly. Although the altered movements did not influence the acceleration time, the effectivness of instructions on start movements cannot be neglected. Since our study could not make conclusions on the most effective source of instructions on the sprint start movements, future studies should use larger sample size and quantitative approach in investigation of this matter.

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Introduction

Running is a fundamental movement skill and an important sports related skill. Fundamental movement skills lay the groundwork for future sports participation. Fundamental movement skills are basic movement patterns that are observable in motor performance. Some of the fundamental skills, such as running, jumping, hopping, catching, and throwing are the essential skills needed for many different sports. However, besides these movement skills, other factors such as physical characteristics, psycho-social characteristics, previous motor experiences, and components of the skill or task also play an important role in further motor skill acquirement.

The development of fundamental movement skills (FMS) begins around two years of age and typically lasts through seven years of age, when most children have obtained the more mature form of each skill (Haubenstricker & Seefeldt, 1986). Upon completion of FMS, children begin to develop more specialized movement skills. Specialized movement skills are simply applications of fundamental movement patterns but in complex and specific forms. Therefore, these skills are more refined and precise than FMS. Additionally, specialized movement skills often involve a combination of fundamental movement abilities. For example, the fundamental movements of hopping and jumping may be applied to performing the triple jump (hop-step-jump) in track and field. It is therefore in the specialized movement skill development, a child starts to connect and apply FMS to the performance of specific sports skills. For example, the child's movements become faster, better controlled, and are executed in a more complete form. All in all, the overall goal of the specialized movement phase is not only in applying existing fundamental movement skills to more specialized movements but in acquiring additional skills and abilities such as coordination, speed of movement, and reaction time (Gallahue & Ozmun, 2006).

Sprinting is one specialized movement skill which places an emphasis on coordination, speed of movement, and reaction time. These abilities are also important for the start of the sprint performance. The sprint start begins with the reaction on a sound stimulus. Reaction time essentially denotes the movement initiation. Once the movement is initiated, coordination plays an important role since the sprint start is a whole body movement. The action of the arms, legs, and the whole body has to be synchronized and precise in order to successfully execute the starting movements. Well coordinated movements will also be characterized by the speed of movements' execution. The purpose of the sprint start action is to create such conditions where initial movement speed increases in subsequent sprinting action.

A proficiently performed sprint start action will be seen immediately in the movements in the first stride(s) after the start and throughout the acceleration phase. These movements are typically referred to as "drive". Since the speed of cyclic movements in the first few strides after the start action is not great (Šnajder & Milanović, 1991), the following drive allows for a gradual increase in speed. The drive includes a forward body lean, proper feet positioning, and vigorous arm action to allow for the advancement of speed throughout the acceleration phase.

The successful execution of the strides following the start is dependent on the body angle with regard to the surface, as well as on the movement speed of the individual. With good running technique and adequate speed of the initial movements, the leg is positioned behind the body's center of gravity (BCG) projection in the first few strides. During subsequent strides, the leg is often positioned in the BCG's projection, and thereafter ahead of its projection. A gradual increase of the stride length, as well as attainment of upright body position, is characteristic for the acceleration phase of the sprint run (Šnajder & Milanović, 1991). Since the speed attained at the end of the acceleration phase is the criterion of the successful start action (Coppenolle, Delecluse, Goris, Diels, & Kraayenhof, 1990; Šnajder & Milanović, 1991; Delecluse et al., 1995), the way the start action is performed may not only determine the sprint time, but subsequent movement characteristics as well. However, there are other factors, or constraints, that can affect sprint start performance.

Constraints are boundaries or features that limit motion and reduce the number of possible configurations of a system (Newell, 1986). Newell (1986) grouped the various features into three categories of constraints: individual, environmental, and task. Individual constraints are internal, biological, or physical constraints. Examples of physical constraints include body size, weight, height, body-segment lengths, and strength. Environmental constraints are external to the individual and are characteristics of either the physical or sociocultural environment (Gagen & Getchell, 2004). Task constraints are focused on the goal of the task, characteristics of the task, the associated rules, or equipment. Accordingly, the motor performance is the interaction between and within constraints imposed by the individual performing the task, the environment surrounding the task, and the task itself. Thelen (1995) suggested that when one aspect of the person-task-environment system is changed, the other aspects are initially disrupted, but after a period of instability, these same aspects may self-organize, accommodate for the original disruption, and result in a new way to perform the skill. The interaction of constraints can either encourage or discourage movements, and have either positive (e.g., promote proficient movement patterns) or negative effects (e.g., promote ineffective movements or inhibit proficient movements) on the development of a movement (Gagen

& Getchell, 2004). For a sprint start this means that if the physical characteristics of the individual, the environment in which the task is being performed, or instructions concerning the sprint start change, the performance may be altered. The effects of this change may be evident in the form of executed movements and/or in the outcome of these movements.

Instructions for a task can be expressed in one of the two general ways: verbally and visually. Verbal instructions are used most widely because they represent the most common way to communicate, and because the largest quantity of information may be expressed verbally. Additionally, verbal information is not easily misinterpreted if expressed clearly. However, a disadvantage of verbal instruction is that, while instructors rely on one-way verbal exchanges as their primary means of transmitting the information, individuals performing the task may rely on predominantly auditory information (Buchanan & Briggs, 1998; Rink, 1993). Visual instruction is another effective method for transmitting information to an individual particularly because actions that are difficult to verbalize can often be demonstrated visually. Performance resulting from visual instructions can be defined as "cognitive, affective, and behavioral changes that result from observing others, while models are individuals whose behaviors, verbalization, and non verbal expressions are attended to by observers and serve as cues for subsequent behavior" (Schunk, 1989).

There are different sprint start types that can be used at different developmental and learning stages. The progression in learning the sprint start includes performing the start from a standing position, a falling position, a 3-point start, and finally, from the most advanced stage, a crouch start.

In the specialized movement phase of motor development most youth are in a favorable position for learning and acquiring more advanced motor skills and abilities.

However, their performance of any motor task, including the sprint start, will represent an outcome of the relationships and interactions of several different constraints. Introducing a new task creates new constraints in the performance of the task. In other words, when youth are presented with a sprint start task using two different methods of conveying the task demands - verbal and visual, youth may or may not accomplish the demands of the sprint start task. Performance effects may be evident in sprint start execution and subsequent movements, as well as in sprinting time in the acceleration phase since speed is a criterion of a successful start action.

Statement of the Problem

There are few research studies that investigated sprint running in children (Šnajder, Milanović, & Hofman, 1996; Papaiakovou et al., 2009; Castro-Piňero et al., 2010). The focus of these studies was on the final sprint time and the different factors affecting it, such as body weight, chronological age, sex, and type of sprint start used. However, there are no studies regarding the sprint start action in children and the effect that different instructions might have on the way the sprint start is performed. Therefore, the purpose of this study was to investigate whether two different types of instructions (verbal and visual) altered the sprint start movements in children and if those alterations impacted the initial acceleration.

Hypothesis

The null hypothesis of this study (H_0) is that verbal and visual instructions will not alter the sprint start movements and the acceleration phase sprint time in children.

The experimental hypothesis of this study (H_1) is that both verbal and visual instructions will alter the sprint start movements and the acceleration phase sprint time in children.

Significance of the Study

The sprint start in children and the factors that influence its performance has not been thoroughly studied. Investigating the effects of various instructions on the sprint start might reveal some of the possible task-related constraints. Identifying all possible constraints is important for understanding the best ways to teach a more advanced skill such as the sprint start in children. The findings of this study might be beneficial to practitioners when trying to find an optimal method of introducing the new goal of the sprint start task.

Review of Literature

In the last fifty years, significant attention has been given to determining the effects that task constraints can have on motor performance. Task constraints include task goals, specific demands of the task, the associated rules, as well as any task-related information (e.g., run as fast as you can, kick to the target). Many studies have been conducted regarding the sources of task-related information, the instructions. However, the findings of these studies have been equivocal mostly due to various motor tasks and strategies used. In assessing the sprinting performance in children and youth, there is a tendency to only focus on the sprint time, that is, the outcome of the performance. On another hand, little attention is being given to skills that might be responsible for this final outcome. Therefore, the purpose of this study was to investigate whether two different types of task-related information altered sprint start movements in children and if those alterations were evident in the sprinting time in the acceleration phase.

Task Constraints

The theory of constraints suggests that, in order to understand why certain movement patterns exist, one must consider not only the characteristics of an individual (individual constraints), but also characteristics of the environment and the task (Gagen & Gatchell, 2004). The individual, environment, and task are interacting, and characteristics of each change can be influenced by other changes taking place. Whereas it is almost impossible for practitioners to influence, or manipulate, individual and environmental constraints, task constraints can be manipulated. Any change in task constraints may induce changes in other constraints. Likewise, any change in individual or environmental constraints may induce changes in task constraints. The effects of these changes will be evident in motor performance. Changes in each part of the task may be one reason why an individual's motor performance is variable. In children and youth, the dynamics of interaction of constraints may be more pronounced than in adults. Children's individual constraints change rapidly over the time. Their physical and psychological characteristics change due to growth and maturation, while motor experiences change as a reflection of interaction with environment (Gagen & Gatchell, 2004). Therefore, youth's motor performance may be considered as a dynamic phenomenon which is constantly being influenced by many different constraints.

Sprint Start in Elite Athletes

The start and a quick acceleration are of utmost importance for successful performance in sprint running. In sprint events, the crouch start from starting blocks is obligatory for all events up to 400 m (IAAF, 2002). However, a standing start is often used by athletes in their training.

In elite athletes, the crouch start has been more widely studied, especially from the biomechanical point of view (Henry, 1952; Baumann, 1976; Mero, Luhtanen, & Komi, 1983; Mero & Komi, 1990; Guissard, Duchateau, & Hainaut, 1992; Schot & Knutzen, 1992; Čoh, Tomažin, & Štuhec, 2006) than the standing start (Ostarello, 2001; Kraan, van Veen, Snijders, & Storm, 2001). Only a few studies have compared both starting techniques (Desiprés, 1973; Gagnon, 1978). Gagnon (1978) suggested that as the body center of gravity is closer to the start line in a standing start, a natural running position could be attained almost immediately. Gagnon (1978) also found that skilled sprinters were 0.03 s faster in the 50m sprint with a crouch start than with a standing start.

However, unskilled sprinters were 0.04 s faster using a standing start. Nonetheless, it was acknowledged that those data might have been biased by the fact that skilled sprinters were more familiar with the crouch start technique (Gagnon, 1978). Desiprés (1973) investigated seventeen experienced sprinters over the first second of a sprint from both standing and crouch start, and found that the crouch start had an advantage over the standing start. The advantage of the crouch start was in an increased BCG velocity after one second and decreased time to cover the certain distance.

Furthermore, others have been interested in changing and controlling the block positions and/or block angles. Henry (1952) found that different block distances resulted in different block velocities (velocity at the end of push-off phase) with the elongated start being the fastest. Schot and Knutzen (1992) found significant differences in between the starting positions in the length of the first step and in the horizontal velocity at the end of the first step (elongated start resulting in larger values than bunch start). Guissard, Duchateau, and Hainaut (1992) concluded that the block clearance velocity increased when the front block angulation was increased, this being due to changed ankle and knee angles and consequently, the muscle lengths at the calf. In elite athletes, there are many variables to consider when investigating the sprint start.

Sprint Running and Children

Sprint running in children has mostly been investigated from factors that might affect the overall sprint performance time such as chronological age and gender (Papaiakovou et al., 2009), and weight status (Castro-Piňero et al., 2010). Papaiakovou et al. (2009) found that from seven to eighteen years of age, gender and chronological age were factors that positively affected running speed during a 30m sprint. Castro-Piňero et al. (2010) investigated the influence of weight status on sprint performance at 20, 30, and

50m sprint across age groups from six to seventeen years of age with a focus on normal weight, overweight, and obese children. The normal weight group showed significantly better performance than their obese and overweight counterparts, while the overweight group had significantly better performances than the obese group. The weight status, gender, and age are among factors that are important for successful sprint performance.

Sprinting is a specialized movement skill, characterized by high speed of movement. Although success in sprinting is often judged by the final outcome, the sprint time, it is important to bring attention to the very initiation of the sprinting movements, the sprint start. Task constraints that might affect the start performance in children have not been thoroughly studied. Šnajder, Milanović, and Hofman (1996) examined the efficiency of a standing and crouch start for a 15m sprint in fifth grade girls. They found that the standing start yielded the fastest sprinting times for 15m, whereas the slowest times were achieved from the crouch start.

Previous studies have focused on sprint time and different factors affecting it, whereas movement characteristics underlying the outcome, sprint time, have not been considered. Instead of focusing on the outcome alone, it is important to teach children and youth proper skills that will be biomechanically sound and eventually produce a solid outcome (e.g., fast time). Therefore, it is important to look at all features of the skill versus focusing on the outcome or end product of the skill. This includes focusing on the task itself. Additionally, although some individual constraints have been investigated (e.g., weight, gender, and age), environmental and/or task constraints have been largely neglected.

Visual and Verbal Instructions

According to Newell (1981), Magill (1993), and McCullagh and Weiss (2001), any task-related information may play an important role in motor skill acquisition and performance. Hodges and Franks (2002) reported that demonstration is particularly effective when the task to be performed consists of putting together movements already a part of the learner's motor repertoire. Furthermore, it has been suggested that watching an expert model perform a task facilitates the development of a correct representation of the expected movement (Bandura, 1971, 1977). However, combining visual and verbal instructions may lead to greater improvement of motor performance in sequencing different parts of a motor skill than providing only verbal instructions (Weiss & Klint, 1987; McCullagh, Stiehl, & Weiss, 1990).

Magill and Schoenfelder-Zohdi (1996), Scully and Newell (1985), and Newell (1981) suggest that task type may influence the effectiveness of information sources. Magill and Schoenfelder-Zohdi (1996) found that multiple sources of instructions are redundant for simple tasks because single sources provide adequate information for the development of cognitive representation of the task and actual performance. On the other hand, numerous sources of instructions are believed to be beneficial for complex tasks as they may provide the necessary information for the development of a better cognitive representation of the task and actual performance (Adams, 2001; Baudry, Leroy, & Chollet, 2006; Hodges, Chua, & Franks, 2003; Laguna, 2004; Tzetzis, Mantis, Zachopoulou, & Kioumourtzoglou, 1999). In other words, for complex tasks both verbal and visual instructions may be beneficial and may complement each other. In that way, information from both sources could potentially enhance an individual’s representation and perception of the multiple components of a complex task. This enhanced representation of the components of the task to be performed might result in an improved performance.

Conclusion

Newell (1986) suggested that motor performance is a product of the interaction between and within constraints imposed by the person, environment, and task. Whereas many studies have investigated the effect of visual and verbal instructions on the motor performance, no clear conclusion can be made regarding the most effective source of instructions. The effectiveness of each source of instructions depends on many different factors, some of which are developmental stage of an individual, motor task used, strategy used in presenting instructions, motivation, etc. The sprint start in children and the effect that verbal and visual instructions might have on its performance and the subsequent acceleration phase time have not been studied.

Methodology

Participants

Eight boys and one girl, aged 11-12 years, were recruited as participants. This age group was selected because it is the time period when children begin the specialized phase of motor development and start applying their acquired skills to more specialized skills. To achieve the power level of 0.80, with the Cohen's *f* effect size of 0.4 and α error probability of .05, the total sample size of 8 was required (Faul, Erdfelder, Lang, & Buchner, 2007). Participants were recruited from a local area after school program. We used a randomized cross-over design utilizing three groups: a control, verbal, and video group. All participants provided their written informed minor assent to participate in this study. Additionally, informed parental consent was obtained. Approval from the Appalachian State University Institutional Review Board was obtained prior to any data collection.

Testing Session Design

The testing procedures included three testing sessions each lasting approximately 60 minutes. All testing sessions were randomized meaning each participant was involved in all three testing protocols. The testing protocols included a control (C), verbal (VE), and video (V). Each group had the same three participants throughout each protocol and was assigned to one intervention per day or testing session. The order of interventions for each group is presented in Table 1. Additionally, each testing session required the participant to perform four (e.g., 2 pre-test, 2 post-test) 30m sprints.

Prior to the first sprint testing session, anthropometrics were taken and a survey on sports participation was collected. Each sprint testing session consisted of a warm-up, pre-test, specific intervention and practice, and post-test.

The warm up was identical for all three groups and consisted of 10 minutes of activity led by the Principal Investigator. Specific exercises are detailed below. Following the warm up, participants began the pre-test which consisted of two 30m sprint performances. A rest period of two minutes was allowed between the two sprints. Instructions before the sprint pre-test included "run fast as soon as possible to the end line". Additionally, all participants were required to start the pre-test sprints using the regular standing start. The better performance (e.g., with better overall sprint time) was selected for analysis. After completion of the sprint pre-test, the intervention (e.g., learning the start) and practice session began. The intervention was different for each group and consisted of either participants watching video instructions on a falling start and subsequent acceleration (V), listening to scripted verbal instructions and practicing a falling start and subsequent acceleration (VE), or having no instructions at all regarding a sprint start but still practicing (C). The intervention and practice sessions lasted approximately 40 minutes. The duration and intensity of these sessions was the same for all groups. Ten minutes after completion of the intervention, the post-test was administered. The post-test was conducted the same way as the pre-test, with the same instructions, distance covered, and outcome measures.

Anthropometrics

Anthropometrics included body mass (kg), height (cm), and sitting height (cm). The measurements were conducted according to the standard and accepted protocols (Lohman, Roche, & Martorell, 1988). All the measurements were taken twice and were conducted by the Principal Investigator. In order to estimate maturity status of participants, sitting height to height ratio was calculated while predicted adult height of participants using mid-parent height was estimated using Khamis-Roche methods (Khamis & Roche, 1994).

Survey

A one page survey on sports participation was also administered. The survey contained questions on current and past sport participation, the duration of sport participation, as well as the questions on the immediate family members' involvement in organized sport (Table 2).

Warm-Up

The warm-up lasted 10 minutes and included the following activities: 1) running at a low intensity while performing butt kicks, sideways running, running backwards, squatting down on a sound signal, and changing running direction on a sound signal for a total of three minutes; 2) interval running consisting of 10 seconds of fast running followed by 15 seconds of slow running (x 4) for a total of three minutes; 3) running at a low intensity followed by slowing down to walking pace for a total of two minutes; and 4) walking on toes, walking on heels, walking on outer (lateral) side of feet, walking on inside (medial) side of feet for a total of two minutes.

30 Meter Sprint

The 30m sprint tests were performed on an outside track near the local school's playground. Variables of interest included the average duration (s) and distance (m) of the acceleration phase for both pre and post-sprint performances. In order to determine more specific details of the sprinting dynamics, pairs of photocells (Brower Timing System, Utah, USA) were placed each five meters from the start line to the 20m sprint distance, with the last pair of photocells being placed from 20m to the finish line. This system allowed for an automatic timing start upon the completion of the start signal. The participant assumed the standing starting position, and at the completion of the start sound signal, ran "fast as soon as possible to the end line". When the participant passed by the photocells, the five mm infrared time beam was triggered and the split running times at 5, 10, 15, 20, and 30m were automatically recorded at TC Timer (Brower Timing System, Utah, USA). From the split running times, interval running velocity (i.e., velocity = distance/time) and acceleration times were calculated.

The Start

In order to observe the start action during each pre and post-test, a camera (Sony, ZR800) was placed 30° to the sprinting direction, and five meters away from the sprint starting line. While all participants started the pre and post-test from a standing start, the video tape recordings and acceleration times were used to assist in determining if participants incorporated any type of drive movements into their start. A rubric (Table 3) was used to identify key features necessary in a sprint start according to biomechanical literature (Luhtanen & Komi, 1978; Mero, Luhtanen, & Komi, 1983; Coppenolle, Delecluse, Goris, Diels, & Kraayenhof, 1990; Šnajder & Milanović, 1991; Mero, Komi, & Gregor, 1992; Delecluse et al., 1995; Donati, 1995; Čoh, Tomažin, & Štuhec, 2006). Starts were classified according to these main features of a sprint start: forward body lean, feet positioning relative to body's center of gravity projection, and arms' action.

Intervention

Video Group

After the sprint pre-test, the V group watched a video that showed skilled youth performing a falling start and subsequent acceleration phase. The video was obtained from a YouTube web site (Shafttuba, 2007), which included demonstrations of different sprint-related skills. In this video, the emphasis was placed on the demonstration of performing key features of the start and acceleration phase, such as leaning forward until the point where balance cannot be kept anymore, and sprint initiation at the point of losing balance. Additionally, no instructions or cues were provided by the Principal Investigator that identified important parts of the falling start. All participants simultaneously watched this muted video, lasting approximately one minute. Following the video, participants lined up at a starting line and performed two sets of six repetitions of 15m sprints for a total of 12 sprints (Baechle & Earle, 2008). Participants were encouraged to practice the start they had just learned; however, no cues or further instructions regarding the start were provided. Each of 15m sprints was separated by two minutes of rest whereas eight minutes of rest was given between the two sets performed (Baechle & Earle, 2008). Practice repetitions were done with all participants at the start line together, allowing them to begin the sprint on their own time, and allowing the Principal Investigator to monitor rest periods as well as repetitions.

Verbal Group

After the sprint pre-test, the VE group was given scripted verbal instructions on a falling start and sprint acceleration. The verbal instructions focused on the most central, or relevant information according to Rink (1993). These cues were: standing on toes and leaning forward until the point where balance cannot be kept anymore, and at the point of losing balance start sprinting. However, these instructions did not include any visual demonstrations of starting technique. After listening to the verbal instructions, participants lined up at a starting line, and were encouraged to practice the start they just learned. Participants performed the same number of sprints (e.g., repetition and sets) as the V group.

Control Group

After the sprint pre-test, the C group did not receive any information regarding a sprint start. However, they still performed the same practice sessions as both the V and VE groups.

Data Manipulation

In order to obtain acceleration times for each pre and post-test sprint performance, interval velocities were first calculated from the sprint split times at 5, 10, 15, 20, and 30m using the formula velocity = meters/second. For example, velocity at 10m was calculated by dividing 10 (distance) with the time (s) achieved at 10m. Acceleration times at each 5m of the sprint were then calculated by dividing velocity at that interval (e.g., velocity at 10m) by the difference between times achieved at 10m and 5m (s). These acceleration times at each 5m were then plotted against times achieved at each 5m in order to obtain an acceleration-time curve for each pre and post-test sprint performance.

Statistical Analysis

Descriptive statistics of physical characteristics and acceleration times at 10m were calculated. Analyses of frequency counts were performed on the sports' participation survey data and on the start movements' rubric data. To determine if there were any significant differences in the acceleration time (m/s^2) throughout different interventions, a repeated measures ANOVA was used with alpha level set at $p \leq 0.05$. All statistical analyses were performed using SPSS, Version 18.0 (SPSS Inc., Chicago, IL, USA).

Results

Our research question was whether acceleration during the first 10m of a 30m sprint changed as a result of instructions provided. Results revealed no significant differences in acceleration time; however, general tendencies of the body movements related to improving the start and thus acceleration phase, changed.

Participants' Physical Characteristics and Sports Participation

The participants' physical characteristics are presented in Table 4. Sitting height to standing height ratio (SH-H), predicted adult height, and current height to predicted adult height ratio of each participant are presented in Table 5. Individual SH-H ratio results show that all participants, besides one, had values greater than 50%.

The results of the survey on the sports participation are shown in Table 2. These results indicate that 77.8% of participants currently participate in sports. Of those, 66.6% played organized sports begining at the age of 7-8 years or earlier. Participants also reported that their family members (66.7%) were not involved in sports suggesting little influence from the family on sports participation.

Start Movements

In order to assess if the instructions affected the sprint start and subsequent acceleration, a qualitative observation of three components of the sprint start was performed (Table 3). Results from the classifications of the components of the sprint start movement features before and after each learning session are presented in Tables 6-8. All participants (100%) showed an erect body position immediately after the start in both the PRE and POST of the C condition (Table 6). After the verbal (VE POST), and visual instructions (V POST), 88.9% of participants exhibited forward leaning body position. In the C condition where no instructions on the start movements were provided, only 22.2% of participants positioned their feet behind the center of gravity immediately after the start (Table 7). However, following the verbal (VE POST), and visual instructions (V POST), 77.8% and 88.9% of participants, respectively, exhibited this same foot position. The action of the arms was categorized based on the level of flexion/extension in the elbow joint. Twenty-two percent of participants in the C PRE, and C POST test, demonstrated the flexion at the elbow joint while over half of the participants (55.6%) flexed their elbows in the VE POST and V POST test (Table 8).

Acceleration Times

The acceleration-time curves for pre and post-test sprint performances for each condition are presented in Figures 1-3. From these figures, it can be observed that the acceleration phase of the sprint for all conditions occured in the first 10m of the sprint run. Descriptive statistics for the acceleration time at 10m (a2) for all measurements are presented in Table 9. The repeated measures ANOVA revealed no significant differences existed in either the main effect (i.e., Time, Condition) or in the interaction (i.e., Time*Condition); $F(2, 16) = 3.18$, $p > .05$, with the $\eta^2 = .28$, and observed power of .53.

Discussion

We hypothesized that instructions on the sprint start would alter the sprint start movements and the acceleration phase time in novice sprinters. Overall, we found no significant differences in acceleration over the first 10m of the sprint; however, starting movements altered after the instructions.

Participants' Physical Characteristics and Sports Participation

Participants' physical characteristics were used to assess their maturity status. Individual SH-H ratio results indicate all participants, besides one, had values greater than 50% (Table 5). The estimation of proximity to predicted adult height indicated that participants have not yet reached their adult heights. Therefore, using the sitting height to height ratio, predicted adult height, and current height to predicted adult height ratio, we suggest the male participants have yet to reach puberty. Prior to attaining maturation, both boys and girls tend to show higher SH-H ratios, indicating growth in the trunk and little growth yet in the legs. In fact, the legs tend to grow after maturation has begun. In addition, peak height velocity, a maturity indicator, typically occurs at or around age 12 years in boys and 10 years in girls. Our participants had an average age of 11.7 years and had SH-H ratios of 51.2% suggesting they are more than likely pre-pubescent. The potential relationship of this to acceleration in sprint performance relates to their relatively shorter legs being a probable disadvantage in the acceleration phase of a sprint. Although an increase in acceleration can be achieved by increasing stride length and/or stride frequency, this is usually done by increasing the stride length (Luhtanen & Komi, 1978; Mero, Luhtanen, Viitasalo, & Komi, 1981; Coppenolle, Delecluse, Goris, Diels, & Kraayenhof, 1990; Šnajder & Milanović, 1991; Mero, Komi, & Gregor, 1992; Delecluse et al., 1995; Donati, 1995; Čoh, Tomažin, & Štuhec, 2006). Stride length is dependent on body height and leg length. Therefore, a pre-pubescent youth may not have the optimal physical characteristics for developing appropriate stride lengths needed for advancement in acceleration.

We expected that at this age (11-12 years old) our participants would already have multiple sports' experiences and should therefore exhibit various performance abilities. For that reason, we administered a sports' participation survey. The results of that survey showed that 66.7% of participants participated in sports and 77.8% were current sports participants. When it comes to the age of the first involvement in organized sport, 66.6% of participants were seven years old or younger. It has been suggested that children with experience in sports participation are better motor performers than the children who do not have such experience (Malina, Bouchard, & Bar-Or, 2004). Therefore, most of our participants did have some previous sports experience and thus may have drawn upon any prior motor experiences when performing this specific task.

Start Movements

A qualitative observation of three body movements related to the acceleration phase of the sprint revealed that both the verbal and visual instructions changed the way the participant performed the start. A proficiently performed start action encompasses movements such as forward body lean, positioning support leg behind the center of gravity, and vigorous arms' action. When no instructions were provided, participants did not exhibit forward body lean unlike the conditions where instructions were provided. Frequency counts for feet position revealed that in a condition without instructions only

22.2% of participants positioned their feet behind the center of gravity in the first two strides following the start. However, after both the verbal and visual instructions, the percentage of participants who showed this category increased. Similarly, instructions altered the arms' action movement, as reflected by the amount of flexion in the elbow joint. However, we were limited to observing these movements from the distance and angle at which the camera was placed. This may not have been the most ideal distance and angle to see exactly what was happening with each movement over the longer distance than only over the first two strides following the start. These driving movements have to be performed throughout the entire acceleration phase in order to ensure for the gradual progression of speed. Nonethless, these observations suggest that verbal or visual instructions may assist children in performing a better sprint start. However, since these features of the sprint start movements were only assesed in a qualitative manner, no conclusions can be made regarding the possible significant differences between the verbal and visual instructions on sprint start movements. Two processes that are presumed to influence the effectivness of instruction type are attention and retention. While researchers have pointed out that the attention in new motor tasks should be directed to relevant task stimuli (Abernethy, 1993; Newell, Morris & Scully, 1985; Magill, 2001), the issue of what is relevant for different skills is problematic. Many aspects of the performance, such as a specific movement form or feature, might emerge as a consequence of the participant's focus on one specific component of instructions (Hodges & Franks, 2002). The effect of instructions on the mechanisms responsible for the production of movement is also important. Zanone and Kelso (1992) suggested that verbal instructions influence an individual's representation of the task and their intention to perform it. Yando, Seitz, and Zigler (1978) found that effectivness of visual instructions is determined by cognitive developmental level and motivational system of an individual. McCullagh, Weiss, and Ross (1989) further concluded that even if a child has necessary physical abilities to reproduce the modeled actions, matching behaviors may not occur because of lack of desire or motivation. It is important to note that one participant in this study had a learning disability; however, none of their data indicated significant outliers. In our study, during all three testing sessions, participants performed four 30m sprints in addition to shorter practice sprints. Since our participants were 11-12 years old, it may be possible that their performance motivation was not always on the same level. Participants might have been highly motivated in the first session but less motivated in the second and third session. Therefore, the effectivness of instructions on sprint start movements might have been affected by participants' motivational system. Additionally, it may be important for practioners to consider multiple sources of instruction to address the focus of the participant to multiple components of a skill.

Instructions should differ for a simple motor task compared to a more complex motor task (Magill and Schoenfelder-Zohdi, 1996; Scully & Newell, 1985; Newell, 1981). The sprint start can be considered a complex motor task. For complex tasks it is believed that multiple sources of task-related information are beneficial to provide necessary information for the development of cognitive representation and actual performance (Adams, 2001; Baudry, Leroy, & Chollet, 2006; Hodges, Chua, & Franks, 2003; Laguna, 2004; Tzetzis, Mantis, Zachopoulou, & Kioumourtzoglou, 1999). For example, when providing instructions on sprint start, both verbal and visual instructions may be beneficial and may actually complement each other. In that way, information from both sources could potentially enhance an individual's cognitive representation of the multiple components of a sprint start. In our study, we only examined single sources of instructions: verbal and visual. It is possible that task-related information provided by a single source were inadequate for the optimal development of cognitive representation and performance of this complex task.

Acceleration Times

Motor performance is often assesed as an outcome of the performance. In our study, the acceleration time at 10m served as an outcome of the start movements' execution. Since sprint time in the acceleration phase is a criterion of the successful start action (Coppenolle, Delecluse, Goris, Diels, & Kraayenhof, 1990; Šnajder & Milanović, 1991; Delecluse et al., 1995), we hypothesized that instructions would alter the acceleration time. Therefore, we investigated the distance of the acceleration phase for each pre and post-test from the acceleration-time curves. From these time curves it was observed that the average post-test performances for both types of instructions had greater/quicker acceleration, however not significant, at the first 5 and 10 meters of the sprint compared to the pre-test performances (Figures 1-3, Table 9). Although there were no statistically significant differences in acceleration time, this finding might still have a practical value. For example, the quicker acceleration observed from the acceleration-time curves following the instructions was most likely due to the altered sprint start movements features. In other words, most of the participants did incorporate some feature of the driving action immediately following the start. However, although acceleration time is a criterion of a successfull start action it is worthwhile to mention that the sprint start is an acyclic action unlike the rest of the sprint action, which is characterized by cyclic movements. Therefore, the acceleration time might not only depend on the success of the sprint start execution but also on the transition between starting action and sprinting action. Although we found some differences in body movements during the start of the sprint, performance of transition between start and sprinting might not have been successfull. In other words, whereas participants seemed to have focused on the start movements, the implementation of those movements into the sprinting action might have suffered.

Similar findings were discovered in studies that intentionally manipulated the attention to a specific component of an action. Temprado, Zanone, Monno, & Laurent (1999) showed that certain coordination patterns could be stabilized by attention to both limbs, or destabilized by attention to one limb. Although one component might be improved the other component might suffer. Therefore, although altered starting movements' should have allowed for the driving movements after the start and with that, greater acceleration, it is likely that coordination patterns following the start destabilized and thus prevented any advancement in acceleration.

Furthermore, some (e.g., Adams, 1986; Vogt, 1996) argue that although instructions can help shape the movement initially, physical practice is needed for effective implementation of these movements. In our study, participants did have a practice period following the instructions. However, there seems to be no concise directions on the appropriate practice time when investigating the short-term effects of the verbal and visual instructions. It is to be expected that practice time would vary considerably according to the complexity of the task to be performed, as well as according to the developmental stage of the participants. Our results suggest that participants altered the sprint start movement features following the instructions and practice. Therefore, it may be assumed that the practice time and intensity used was adequate for inducing changes in start movements' features. Nonetheless, since these altered sprint start movements did not change the performance outcome, acceleration time; it is likely that greater practice time might be needed for more effective implementation of these movements.

Conclusion

In many motor tasks, the effectiveness of instructions is evaluated using performance outcomes (e.g., time). However, it is suggested that the effectiveness of the instruction needs to be determined based on its influence on the movement form or outcome success, in situations where these two can be separated (Hodges & Franks, 2002). Furthermore, instructions might differentially impact on outcome success and movement form, and therefore effectiveness should be judged accordingly (Hodges & Franks, 2002). Although the instructions in our study did not significantly impact acceleration time, the effectiveness of verbal and visual instruction on altering sprint start movement cannot be neglected.

Limitations and Practical Implications

Limitations to this study include the small sample size and different environmental factors (temperature, wind) during different testing sessions. Prior to the data collection, we expected to find large differences in acceleration time between different conditions and to confirm those conclusions with the power of 80%. However, the results of the study showed that large differences (Cohen's *f* effect size) could not be found in this sample size.

Nevertheless, the findings of this study can still be beneficial to practitioners when trying to teach children sprint start movements. Start movements' features can be altered using both short-term verbal and visual instructions. Practitioners need to be aware that even when movement form is altered, the advantage of this improved form does not have to immediately translate into the performance outcome. Accordingly, the successfulness of skill acquirement should not be judged only by performance outcome which is often a case. This notion is especially important when youth are in early skill acquisition phase.

Therefore, it is important for practitioners to be aware of all possible constraints that can affect both movement features and movement outcome.

Future Studies Recommendations

Single sources of instructions, such as verbal and visual, can improve the sprint start movements' features. Since our study could not make conclusions on the most effective source of instructions on the sprint start movements, future studies should use larger sample size and quantitative approach in investigation of this matter. Additionally, when investigating the effect of instructions on the outcome, acceleration time, more research regarding the minimal practice time needed for significant improvements in acceleration time is warranted.

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LIST OF TABLES

Table 1

Randomization of Interventions for Each Group

Group	Day 1	Day 2	Day 3
1	Control	Verbal	Video
2	Verbal	Video	Control
3	Video	Control	Verbal

Table 2

Previous Sports Participation and Experiences among Participants

Item		Frequency	%
Currently Participates In Sport	1 (No)	2	22.2
	2 (Yes)	7	77.8
Length of Time Participating In Current Sport	0 (None)	2	22.2
	1 (< than 3 months)	1	11.1
	2 (3-6 months)	2	22.2
	4 (> than 6 months)	4	44.4
Participated In Multiple Sports	1 (No)	3	33.3
	2 (Yes)	6	66.7
Age Started Sports Participation	0 (None)	2	22.3
	1 (around 6 yrs)	3	33.3
	2 (7-8 yrs old)	3	33.3
	4 (9-10 yrs old)	1	11.1
Older Siblings that Play Sports	0 (No older siblings)	1	11.1
	1 (No)	5	55.6
	2 (Yes, 1 sibling)	3	33.3
Younger Siblings that Play Sports	0 (No younger siblings)	2	22.3
	1 (No)	6	66.7
	3 (Yes, 2 siblings)	1	11.0
Parents Participated In Sports	1 (No)	6	66.7
	2 (Yes)	3	33.3

Table 3

Sprint Start Movement Features and Corresponding Categories

Movement Feature	Category Description	
Body Position	Leaning forward (falling)	A
	Erect (stationary)	B
Feet position	Support leg behind center of gravity	A
	Support leg in center of gravity	B
	Support leg in front of center of gravity	C
Arms' Action	Arms flexed at 90°or more	A
	Arms extended below 90°	B

Note. Sprint start movement features were observed throughout the first two strides following the sprint start action.

Table 4

Physical Characteristics of Participants

Characteristic	*N*	*Min*	*Max*	*M*	*SD*
Age (yrs)	9	11.3	12.3	11.7	.35
Weight (kg)	9	35.2	52.2	43.2	5.52
Height (cm)	9	145.4	163.4	153.8	5.28
Sitting Height (cm)	9	72.4	84.4	78.8	3.85
SH-H Ratio (%)	9	49.8	53.9	51.2	1.20

Note. Number of participants (N), average value (M), minimal (MIN), and maximal (MAX) result, standard deviation (SD).

Table 5

Maturity Status Indicators for Individual Participants

Participant	SH-H Ratio	Estimated Adult Height(cm)	H-EH Ratio
1	51.48	181.00	82.04
2	50.08	184.00	83.89
3	51.34	190.00	83.24
4	51.41	190.00	80.37
5	53.90	169.00	92.66
6	50.29	181.00	84.53
7	51.23	177.00	86.02
8	49.81	175.00	83.06
9	51.50	186.00	87.85

Note. Values for estimated adult height were obtained using Khamis-Roche method which takes into account individual's age, height, weight, sitting height, gender, and mid-parents height.

Table 6

Body Position Categories throughout Conditions

Measurement	Category	Frequency	%
C PRE	A	0	0
	B	9	100
C POST	A	0	0
	B	9	100
VE PRE	A	0	0
	B	9	100
VE POST	A	8	88.9
	B	1	11.1
V PRE	A	1	11.1
	B	8	88.9
V POST	A	8	88.9
	B	1	11.1

Note. A: Leaning forward movement; B: Stationary position.

Table 7

Feet Position Categories throughout Conditions

Measurement	Category	Frequency	%
	A	2	22.2
C PRE	B	5	55.6
	C	2	22.2
	A	0	0
C POST	B	8	88.9
	C	1	11.1
	A	1	11.1
VE PRE	B	8	88.9
	C	0	0
	A	7	77.8
VE POST	B	2	22.2
	C	0	0
	A	1	11.1
V PRE	B	8	88.9
	C	0	0
	A	8	88.9
V POST	B	1	11.1
	C	0	0

Note. A: Feet behind center of gravity; B: Feet in center of gravity; C: Feet in front of center of gravity.

Table 8

Arms' Action Categories throughout Conditions

Measurement	Category	Frequency	%
C PRE	A	2	22.2
	B	7	77.8
C POST	A	2	22.2
	B	7	77.8
VE PRE	A	4	44.4
	B	5	55.6
VE POST	A	5	55.6
	B	4	44.4
V PRE	A	6	66.7
	B	3	33.3
V POST	A	5	55.6
	B	4	44.4

Note. A: Arms flexed at 90° or less; B: Arms extended more than 90°.

Table 9

Descriptive Statistics of 10m Acceleration Time

Measurement	*N*	*M*	*SD*	ΔPre-Post
C-PRE a2	9	2.10	.17	
C-POST a2	9	2.08	.12	- .02
VE-PRE a2	9	2.03	.21	
VE-POST a2	9	2.21	.15	.18
V-PRE a2	9	2.15	.18	
V-POST a2	9	2.33	.12	.18

Note. The distance of the acceleration phase (10m) was obtained from the acceleration-time curves of each measurement. Number of participants (N), average value (M), standard deviation (SD), difference between pre and post-test acceleration time (Δ Pre-Post).

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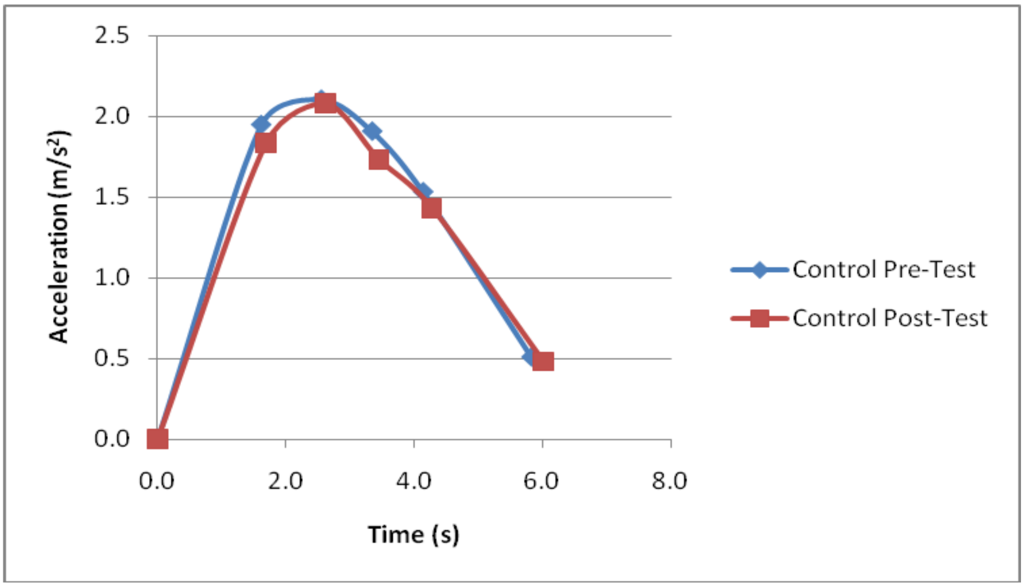

Figure 1. Acceleration-Time Curves for Pre and Post-Test in a condition where no instructions on sprint start were provided (C). The squares/dots on the curve lines represent the acceleration and time achieved at the specific sprint distance (1st square represents acceleration at 0m, 2nd square represents acceleration at 5m, 3rd square acceleration at 10m, etc.). Values represent averaged data from all participants.

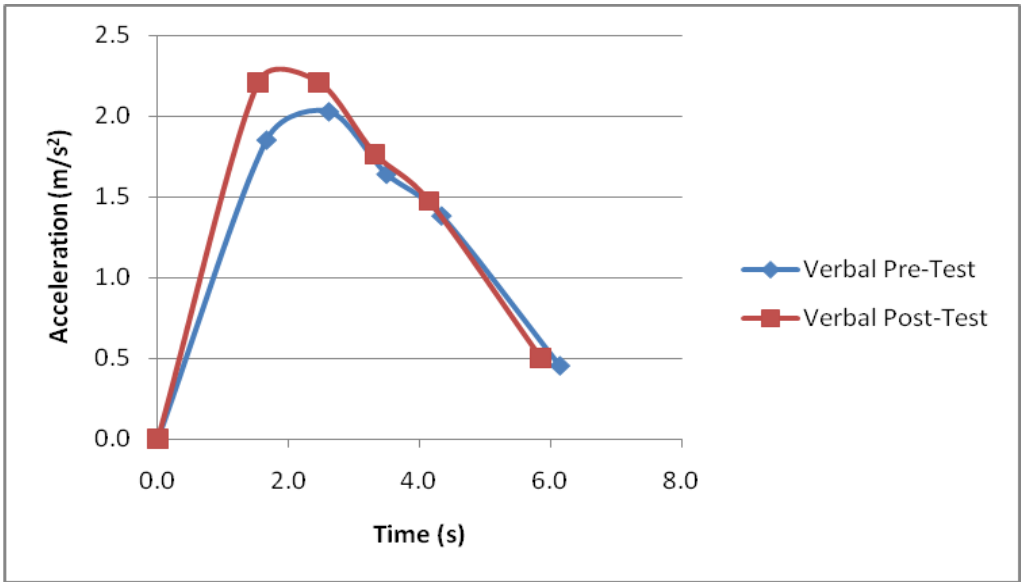

Figure 2. Acceleration-Time Curves for Pre and Post-Test in a condition where verbal instructions on sprint start were provided (VE). The squares/dots on the curve lines represent the acceleration and time achieved at the specific sprint distance (1st square represents acceleration at 0m, 2nd square represents acceleration at 5m, 3rd square acceleration at 10m, etc.). Values represent averaged data from all participants.

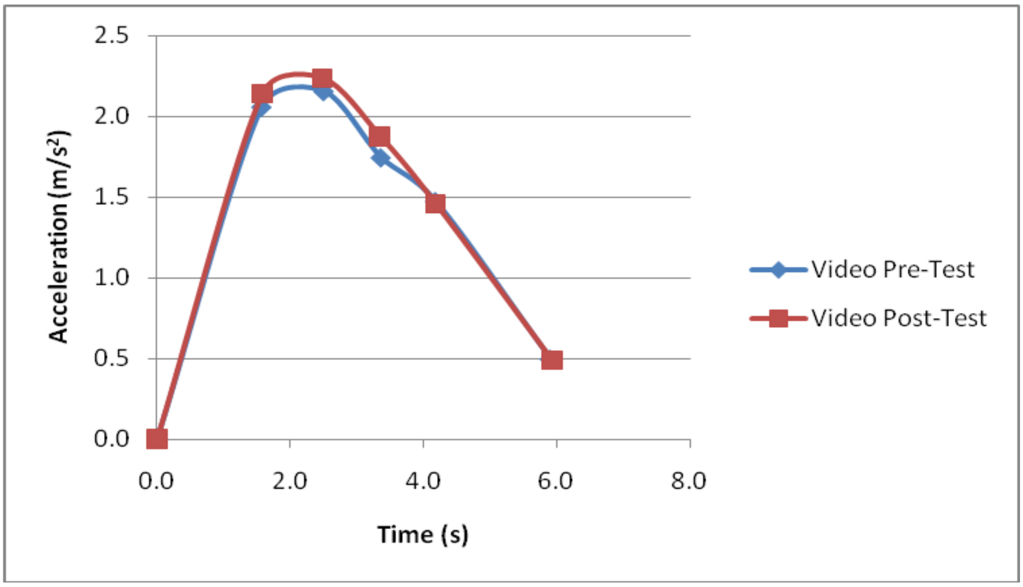

Figure 3. Acceleration-Time Curves for Pre and Post-Test in a condition where visual instructions on sprint start were provided (V). The squares/dots on the curve lines represent the acceleration and time achieved at the specific sprint distance (1stsquare represents acceleration at 0m, 2nd square represents acceleration at 5m, 3rd square acceleration at 10m, etc.). Values represent averaged data from all participants.

APPENDIX A

SPORTS' PARTICIPATION SURVEY

Sports' Participation Survey

ID:_______________

1. Do you practice any sport at the moment?

□ No □ Yes (name the sport): ___________________________________

2. If you answered yes on question 1., how long have you practiced that sport?

□ Less than 3 months □ About 3-6 months □ About 6 months □ More than 6 months

3. Did you train in any other sports, and if yes, which ones?

□ No □ Yes ____

4. How old were you when you first started practicing some sport?

□ around 6 yrs old □ 7-8 yrs old □ 8-9 yrs old □ 9 -10 yrs old □ 10-11 yrs

5. How many older siblings do you have?

□ 1 brother/sister □ 2 brothers/sisters □ 3 brothers/sisters □ 4 brothers/sisters

6. How many younger siblings do you have?

□ 1 brother/sister □ 2 brothers/sisters □ 3 brothers/sisters □ 4 brothers/sisters

7. Do any of your older siblings play sports?

□ No □ Yes: □ 1 brother/sister □ 2 brothers/sisters □ 3 brothers/sisters

8. Do any of your younger siblings play sports?

□ No □ Yes: □ 1 brother/sister □ 2 brothers/sisters □ 3 brothers/sisters

7. Did your parents play sports?

□ Yes □ No

APPENDIX B

MINOR ASSENT FORM

Department of Health, Leisure and Exercise Science Appalachian State University

MINOR'S ASSENT FORM

Sprinting Patterns in Youth Initiating From Two Different Types of Starts

We are asking if you are willing to be in our sprint study to see if you can run faster after learning how to do a sprint start. We will split you into smaller groups and each group will learn how to do a sprint start. Because you are a member of Watauga County Parks and Recreation Department of Youth Athletics or the Western Youth Network we are asking if you want to be in this study. A study like this will be most valuable to scientists, teachers, and youth your age.

We will ask you to sprint multiple times, similar to what you would do in a sports practice. You will be asked to do a total of four longer sprints (about 40 meters). These will be done as if you were racing. We will also ask you do to a number (about 12) of shorter sprints. These will not be timed, and will be of a shorter distance (about 20 meters). We will have lots of time to rest and recover in between each sprint. On the day that we have you participate, we'll measure your height, sitting height, and weight (but don't worry, nobody else will see this information). Then, you'll complete a short survey about the sports you have participated in over the past few years. You can ask any questions that you have about this study. If you have a question later that you didn't think of now, you can ask us next time.

As with any participation in physical activity, there are some potential risks. The benefits of this project far outweigh the risks. By participating in this study, you may learn how to do a sprint start. This information may also assist coaches and physical education teachers how to teach youth your age how to sprint and start a sprint. The only risks you may experience being a participant in this study are the same you would if you were at a sports practice. This includes some muscle soreness and overall tiredness from running a lot. Remember, during the activities there will be 1-2 research assistants from Appalachian State University supervising the activity. Signing here means that you have read this paper, or had it read to you, and that you are willing to be in this study. If you don't want to be in this study, don't sign. If you sign this form but later change your mind, you can drop out of the study at any time. Remember, being in this study is up to you, and no one will be mad at you if you don't sign this or even if you change your mind later. The researchers conducting this study are Ana Delalija and Dr. Rebecca Battista. You may ask them any questions you have at any time now or during the study. If you have any questions later, you may contact Ana Delalija at 828-773-7981. If you have further questions about your rights as a research participant, you may contact the IRB administrator at Appalachian State University: 828-262-7981.

Printed Name of Participant ___________________________________

Signature of Participant _____________________ Date ______________

Signature of Investigator ____________________ Date ______________

APPENDIX C

PARENTAL CONSENT FORM

PARENTAL CONSENT FORM
Sprinting Patterns in Youth Initiating From Two Different Types of Starts

Your child is invited to participate in a research study about movement patterns and times spent in different phases of a 40 meter sprint. Your child was selected as a possible participant for this study because he/she participates in programs at the Western Youth Network or in sports offered by the Watauga County Parks and Recreation Department of Youth Athletics. The results of this study may assist physical educators and coaches in understanding parts of a sprint and how the start of a sprint affects performance. Additionally, the findings of this study may provide some valuable tools concerning how to teach youth complex movement skills. We ask that you read this form and ask any questions you may have before agreeing to have your child participate in the study.

I. THE STUDY
This study examines two different ways to teach a sprint start and determines how the start may alter sprinting patterns or sprinting performance. GROUPS. Your child will be randomly placed into one of three groups. Depending on the group he/she is placed will dictate the way we teach the sprint start. The three groups consist of a control group, a video group, and a verbal group. If your child is in the control group they will receive no instructions on how to start a sprint, they will perform the sprint start from the normal standing position. If they are part of the video group, they will watch a video of a youngster performing a sprint start for a race. If they are part of the verbal group, they will be provided with instructions and cues about how to perform what is called a water fall start. This type of start begins from a standing position and encourages the athlete to fall forward, which leads into the initial phase of the sprint. In order to understand the start and initial phase of the sprint, all participants, regardless of group placement, will perform both a pre and post-test. PRE-TEST. Following an appropriate warm-up, your child will perform the two of four 40 m sprints. This is the pre-test. PRACTICE. Next, if your child is in one of the two learning groups, they will either watch the video or listen to the verbal instructions. If they are in the control group, they will begin the next part of the testing session, the practice session. During practice, your child will be asked to sprint only 20meters. Total number of sprints will be 12, with adequate rest periods placed in between each sprint. This is designed similar to any track practice session. Once all practice sprints are performed, all participants will rest for 10 minutes before performing the post-test. POST-TEST. The post-test is the same as the pre-test, where your child will perform two 40meter sprints. Both the pre and post-test will be timed and videotaped. The timing device will record split times at each 5meters of the sprint. The video camera will only be placed at the start and will be used to determine if your child incorporated a drive phase in their start as well as the type of start they used. Researchers and Graduate Students from Appalachian State University will supervise all aspects of the practice and pre and post-tests. OTHER MEASURES. In addition to the sprints, we will also measure your child's height, weight, and sitting height. These will be done in order to determine limb lengths as they act as levers during a sprint. Your child will also be asked to complete a short survey describing their previous sports experiences. Finally, we are asking you to submit your height on the consent for below. We will use the average of the parents' heights in order to determine the maturational status of your child. Maturation is important to our study as it allows us to further understand the movement patterns as those who have achieved maturation will most likely have faster sprint times.

II. RISKS
Your child will be asked to sprint multiple times but at intensity levels and distances that are similar to his/her regular athletic practice. The techniques used in this study do not pose any risks beyond that of their normal athletic practice. However, we will watch your child very closely

during the activity sessions to make sure everyone is safe. Pre and post-test sprints will be performed one at a time, while practice sessions will be performed in groups. Adequate rest periods will be provided after each sprinting bout, both during the pre and post-test and practice sessions. During testing sessions, there will be 1-2 research assistants from ASU, in addition to the Principal Investigator, supervising the activity.

III. BENEFITS
Benefits to your child include learning to start a race, as well as details into each phase of the sprint (e.g., sprint times at each 5 meters).

IV. CONFIDENTIALITY
The data from this study will be kept private. All data will be tabulated using subject identification numbers rather than names. No personal identifying information will be included in any published results of this study. Consent forms will be kept secure, along with results, for five years after the completion of this study.

V. VOLUNTARY NATURE / QUESTIONS
Your decision whether or not to participate will not affect your current or future relations with the Western Youth Network or Watauga County Parks and Recreation Department of Youth Athletics or Appalachian State University. If you decide to allow your child to participate, you are free to withdraw your child at any time without affecting your relationship with Watauga County Parks and Recreation Department of Youth Athletics, Western Youth Network or Appalachian State University. Furthermore, your child may also choose to discontinue participation at any time. The researchers conducting this study are Ana Delalija and Dr. Rebecca Battista. You may ask them any questions you have now. If you have any questions later, you may contact Ana Delalija at 828-773-7981. If you have further questions about your rights as a research participant, you may contact the IRB administrator at Appalachian State University: 828-262-7981.

Child's Name ____ Grade____________

Signature of Parent ____________________________________ Date _____________

Mom's Height ____________________ Dad's Height ___________________

Signature of Researcher________________________________ Date _____________

APPENDIX D

IRB APPROVAL

Appalachian STATE UNIVERSITY

INSTITUTIONAL REVIEW BOARD
Office of Research Protections
ASU Box 32068
Boone, NC 28608
828.262.2130
Web site: http://www.orsp.appstate.edu/protections/irb
Email: irb@appstate.edu
Federalwide Assurance (FWA) #00001076
IRB Reg. #0001458

To: Ana Delalija
Health, Leisure & Exercise Science
CAMPUS MAIL

From: Dr. Timothy Ludwig, Institutional Review Board

Date: 12/20/2010

RE: Notice of IRB Approval by Expedited Review (under 45 CFR 46.110)

Study #: 11-0154

Sponsors: University Funded
Study Title: Sprinting Patterns in Youth Initiating From Two Different Types of Starts
Submission Type: Initial
Expedited Category: (7) Research on Group Characteristics or Behavior, or Surveys, Interviews, etc., (4) Collection of Data through Noninvasive Procedures Routinely Employed in Clinical Practice
Sponsors: University Funded
Approval Date: 12/20/2010
Expiration Date of Approval: 12/19/2011

This submission has been approved by the Institutional Review Board for the period indicated. It has been determined that the risk involved in this research is no more than minimal.

Investigator's Responsibilities:

Federal regulations require that all research be reviewed at least annually. It is the Principal Investigator's responsibility to submit for renewal and obtain approval before the expiration date. You may not continue any research activity beyond the expiration date without IRB approval. Failure to receive approval for continuation before the expiration date will result in automatic termination of the approval for this study on the expiration date.

You are required to obtain IRB approval for any changes to any aspect of this study before they can be implemented. Should any adverse event or unanticipated problem involving risks to subjects occur it must be reported immediately to the IRB. Best wishes with your research!

CC:
Rebecca Battista, Health, Leisure And Exercise Sci

VITA

Ana Delalija was born on July 6, 1979 in Zagreb, Croatia. She attended elementary school and high school in Dubrovnik. After graduating from Grammar high school in 1997, Ana moved again to Zagreb to enter Faculty of Kinesiology at University of Zagreb. In July 2007 she was awarded the Bachelor of Physical Education degree with a minor in Basic Physical Strength and Conditioning in Athletes. During and following her college years, Ana worked in several fitness centers as a strength and conditioning coach and as a swimming coach in summer camps for children. In the fall of 2007 Ana joined the faculty at Faculty of Kinesiology where she worked as an instructor of the Track and Field class. She remained on that position until the fall of 2009 when she began studying towards the Master of Science degree in Exercise Science at Appalachian State University. Upon graduating from Appalachian State University, Ana will apply for a Ph.D in Motor Development.

Ana's parents are Dragica Delalija and Pero Delalija, residing in Dubrovnik. Ana also has an older sister, Nikica, who resides in Zagreb, Croatia.